Journal of Organizations, Technology and Entrepreneurship
https://www.acadlore.com/journals/JOTE

The Influence of Digital Transformation in Enterprises on the Dynamics of Supply Chain Concentration: An Empirical Analysis of Chinese A-Share Listed Companies

Gongwen Xu[1], Dhakir Abbas Ali[1*], Amiya Bhaumik[1], Mingshun Yang[2], Ning Wang[3]

[1] Faculty of Business and Accountancy, Lincoln University College, 47301 Petaling Jaya, Malaysia
[2] School of Mechanical and Precision Instrument Engineering, Xi'an University of Technology, 710048 Xi'an, China
[3] School of Management, Shandong Technology and Business University, 264005 Yantai, China

[*] Correspondence: Dhakir Abbas Ali (drdhakir@lincoln.edu.my)

Received: 10-05-2023 **Revised:** 11-20-2023 **Accepted:** 12-05-2023

Citation: Xu, G. W., Ali, D. A., Bhaumik, A., Yang, M. S., & Wang, N. (2023). The influence of digital transformation in enterprises on the dynamics of supply chain concentration: An empirical analysis of Chinese A-share listed companies. *J. Organ. Technol. Entrep.*, *1*(2), 88-97. https://doi.org/10.56578/jote010202.

Abstract: The advent of digital technology has fundamentally altered the traditional modes of information exchange within enterprises, thereby impacting the concentration of supply chains. This study presents an empirical examination of the effects and underlying mechanisms by which digital transformation influences supply chain concentration, utilizing data from Chinese A-share listed companies spanning 2011 to 2021. The findings reveal that digital transformation enhances information transparency and reduces transaction costs, consequently contributing to a decrease in the concentration of enterprise supply chains. It is observed that the adoption of digital transformation leads to a significant diminution in supply chain concentration, a conclusion that retains its significance even under robustness testing. Further investigation indicates a more pronounced impact of digital transformation on diminishing the concentration of state-owned enterprise supply chains compared to their non-state-owned counterparts. This research enriches the understanding of the impact of digital transformation on supply chain concentration, offering theoretical support for the acceleration of a unified large market development in China. The study underscores the transformative role of digital technology in reshaping enterprise supply chains, highlighting the necessity for strategic digital integration in modern business practices.

Keywords: Digital transformation; Supply chain concentration; Information transparency; Chinese listed companies; Enterprise supply chain management

1. Introduction

In the era of the digital economy, the prevailing business logic has undergone substantial reconfiguration, compelling a systematic transformation in corporate objectives, governance structures, and internal management practices (Qi & Xiao, 2020). A pivotal development in this context was the 2022 issuance of the *Guidelines for Digital Transformation of Small and Medium-sized Enterprises* by the Chinese government, which aimed to bolster the comprehensive strength of enterprises through digital transformation. The advent of digital transformation serves as a critical pathway for micro entities to achieve rapid development, infusing them with essential competitive vitality (Matarazzo et al., 2021). This transformation has far-reaching implications for business operations, processes, and models, directly influencing enterprise growth and the broader trajectory of industrial digitization within China's digital economy (Ni & Liu, 2021). The strategic importance of digital transformation for long-term enterprise development and strategic planning cannot be overstated.

Recent scholarly efforts have explored the varied dimensions of digital transformation's impact on micro entities, covering areas such as the capital market (Wu et al., 2021), labor income share (Xiao et al., 2022), total factor productivity (Wang et al., 2023a), analyst forecasts (Wang et al., 2023b), business performance (Liu, 2023), enterprise market value (Huang & Xi, 2022), and cost stickiness (Zhao & Huang, 2022). Despite this breadth of

research, the specific influence of enterprise digital transformation on supply chains has received comparatively limited attention. Most existing studies consider the supply chain as a factor influencing other economic outcomes (Li et al., 2021; Liu, 2023; Zhao & Huang, 2022), leaving a gap in understanding its direct relationship with digital transformation.

Addressing this gap, the present study utilizes data from Chinese A-share listed companies spanning 2011 to 2021, employing the Digital Transformation Index as a measure of enterprises' digital transformation levels. This research empirically assesses the impact of digital transformation on enterprise supply chain concentration. The potential contributions of this study are manifold: Firstly, it explores the mediating role of enterprise digital transformation in the context of supply chain concentration and information costs, shedding light on the nexus between these elements. Secondly, regarding data, the Digital Transformation Index adopted here encompasses six key dimensions: strategic leadership, technology-driven initiatives, digital achievements, and digital applications, offering a more comprehensive evaluation of digital transformation compared to previous indices. Thirdly, the research paradigm of this study, drawing on Wu Fei's *Benchmark Analysis Heterogeneity Testing Mechanism Analysis* (Wu et al., 2021), delves into the pathway relationship between digital transformation and supply chain concentration.

2. Literature Review and Research Hypotheses

2.1 Digital Transformation and Supply Chain Concentration

Current competitive dynamics in business have transitioned from individual enterprise competition to supply chain competition, with supply chain concentration significantly impacting long-term development prospects (Wang et al., 2021). Analyzing from the transaction cost theory perspective, an enterprise engaging with a multitude of customers and suppliers incurs elevated costs in information search, negotiation, supervision, and design processes. Conversely, a streamlined network involving fewer customers and suppliers can curtail these costs (Coase, 1993). Resource dependence theory posits that enterprises relying on a network of upstream suppliers and large downstream customers can benefit from enhanced information sharing and resource complementarity (Wang & Chen, 2020).

The concentration of a company's supply chain is predominantly influenced by two factors:

(1) Enterprises strive to increase supply chain concentration, which involves dealing with fewer customers and suppliers, to mitigate costs associated with information search, negotiation, design, and supervision.

(2) From the standpoint of optimizing information acquisition and leveraging resource complementarity, enterprises tend to favor a more concentrated supply chain.

The concept of digital transformation is characterized by the transition wherein advanced digital technologies supplant traditional methods within operational and service processes (Ebert & Duarte, 2018). Digital technology acts as a catalyst in expediting message exchanges and resource connections along the supplier-customer chain (Zhao & Huang, 2022). Furthermore, it enhances the precision of supply and demand matching, effectively addresses information asymmetry between upstream and downstream enterprises, thereby augmenting supply chain efficiency (Zhang, 2022). A simultaneous and profound transformation in the supply and demand facets of the supply chain is driven by digital technology (Chen & Liu, 2021). Post-implementation of digital technologies, enterprises have witnessed accurate aggregation of extensive data, fulfilling the requisites for timely discernment of diverse consumer needs and ongoing tracking. The efficacy and speed of information exchange within and beyond enterprise boundaries have significantly improved (Nambisan et al., 2019). Digital transformation in distribution enterprises prompts both upstream and downstream entities in the supply chain to overcome data silos, accessing copious amounts of end-chain data through digital means. This capability enables enterprises to rely on efficient information feedback mechanisms for scientifically forecasting supply and demand scenarios. Business analytics grounded in big data can disrupt the traditional vertical supply chain hierarchy of "supplier-manufacturer-wholesaler-retailer" (Chen et al., 2020). Moreover, the integration effect facilitates technological cooperation and optimized resource allocation among supply chain enterprises through information sharing (Zhang & Zhang, 2022).

Consequently, it can be deduced that digital transformation may diminish the costs associated with information search between upstream and downstream supply chains and enhance the resource-sharing capabilities of these industrial chains. This leads to the formulation of the first hypothesis:

H1: The digital transformation of enterprises can reduce the cost of information acquisition, thereby decreasing the concentration of the supply chain.

2.2 Heterogeneity of Supply Chain Concentration in Enterprise Digital Transformation

The heterogeneity in supply chain concentration during enterprise digital transformation can be markedly observed between state-owned and non-state-owned enterprises. The unique "quasi-official" status of executives

in state-owned enterprises inclines them towards actively endorsing digital transformation (Sajnóg & Rogozińska-Pawełczyk, 2022). These enterprises, leveraging their national reputation, can more readily access resources and market shares, benefiting from inherent advantages in chain embedding. They typically encounter less competitive pressure in the market. Additionally, the scale advantage of these organizations negates the necessity for providing extensive commercial credit, unlike smaller and medium-sized enterprises. A high concentration of customers elevates company risk, potentially leading to issues like liquidity encroachment and fund chain disruptions (Zhang & Zhang, 2023). Excessive supply chain concentration can pose significant risks. In contrast, state-owned enterprises are equipped with more robust capabilities for risk prevention, identification, and management. Considering resource acquisition and risk mitigation, state-owned enterprises are more likely to diversify their customer and supplier base compared to their non-state-owned counterparts. Thus, the proposed hypothesis is as follows:

H2: The digital transformation will exert a more pronounced impact on reducing supply chain concentration in state-owned enterprises than in non-state-owned enterprises.

2.3 The Mechanism of the Impact of Enterprise Digital Transformation on Supply Chain

Digital transformation permeates through all strata of an enterprise, playing a pivotal role in mitigating information asymmetry and bolstering corporate governance levels. It effectively addresses the issue of information asymmetry between buyers and sellers (Skiti et al., 2022). Digital capabilities facilitate the dismantling of barriers to information dissemination within companies, as well as between companies and their upstream and downstream partners, and the external environment. This transformation of digital technology converts complex data into actionable transaction information, minimizes supply and demand discrepancies, enhances matching efficiency, and assists in reducing transaction costs and streamlining business processes. Moreover, digital transformation fosters an increased willingness and capability among upstream and downstream companies to engage in information sharing. It enhances information transparency for managers, employees, users, external regulators, and other stakeholders. This increased transparency aids in rectifying information asymmetry, refining market expectations, and ensuring that external investors are privy to high-quality accounting information. Consequently, the following hypothesis is proposed:

H3: Digital transformation can diminish the concentration of companies' supply chains by enhancing information transparency.

3. Research Design

3.1 Sample Source and Sample Selection

For this study, data pertaining to A-share listed companies from 2011 to 2021 were selected as the initial research sample. The processing of this data involved several steps: exclusion of ST or *ST stocks; omission of companies in the financial sector; removal of firms listed on the Beijing Stock Exchange; exclusion of companies newly listed within the year under review. Furthermore, to minimize the impact of outliers, tail reduction treatments at the 1% and 99% levels were applied to all micro-level continuous variables. All raw data utilized in this study were sourced from CSMAR.

3.2 Variables Definition

Dependent variable

Supply Chain Concentration (Scii): This study employs the average of the sum of the concentration of the top 5 suppliers and the concentration of the top 5 customers to represent supply chain concentration.

Core explanatory variables

Digital Transformation Index: Informed by prior research, this study utilizes the Digital Transformation Index to gauge the degree of digital transformation. The Index is computed by weighting six indicators: strategic leadership, technology-driven initiatives, organization empowerment, environment support, digital achievements, and digital applications.

Mediating variables

Discretionary Accrual Earnings (DA): Based on the modified Jones model, this variable is quantified by calculating controllable accrued profits by year and industry. The larger the absolute value of discretionary accrual earnings, the more significant the potential for earnings management, and consequently, the lower the information transparency.

$$\frac{TA_{i,t}}{A_{i,t-1}} = \beta_0 \frac{1}{A_{i,t-1}} + \beta_1 \frac{\Delta REV_{i,t}}{A_{i,t-1}} + \beta_2 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) + \varepsilon_{i,t} \quad (1)$$

$$NDA_{i,t} = \hat{\beta}_0 \frac{1}{A_{i,t-1}} + \hat{\beta}_1 \frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} + \hat{\beta}_2 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \quad (2)$$

$$DA_{i,t} = \frac{TA_{i,t}}{A_{i,t-1}} - NDA_{i,t} \quad (3)$$

In Eq. (1), *i* represents the enterprise in question and *t* represents the year; *TA* represents the total accrual earnings, *A* represents the total assets of the year; ΔREC indicates the change in operating income, *PPE* indicates the net fixed asset value at the end of the period. In Eq. (2), *NDA* indicates the non manipulative accrued profit, and ΔREC indicates the change in accounts receivable.

Control variables

In this article, the following were selected as control variables, enterprise age (Age), board size (Board), revenue growth rate (Growth), asset liability ratio (lev), total asset net profit margin (ROA), operating cost ratio (Cost), and sales period expense ratio (Fee), and their details are given in Table 1.

Table 1. Variable description

Variable Type	Variable	Variable Description
Dependent variable	Scii	Supply chain concentration: see above
Explanatory variable	Digital	Digital Transformation Index: Comprehensive Indicator of Enterprise Digital Transformation
Mediating variable	DA	Discretionary Accrual Earnings: Discretionary Accrual Earnings Calculated Using the Modified Jones Model
Control variables	Age	Enterprise age: Observation year - IPO year
	Board	Board size: Number of board directors
	Growth	Growth rate of operating revenue
	lev	Asset liability ratio: total liabilities/total assets
	ROA	Net profit margin of total assets
	Cost	Operating cost ratio: operating cost/operating revenue
	Fee	Sales period expense rate: (management expenses+sales expenses+financial expenses)/operating income

3.3 Model Construction

As the sample data is panel data, it is more appropriate that the Hausman test is used in fixed effects model to remove the effect of individual effects on enterprises. The testing model is set as follows:

$$\text{Scii}_{i,t} = \beta_1 + \beta_2 \text{ digital}_{i,t-1} + \sum \beta \text{ Control}_{i,t} + \sum \text{Firm} + \sum \text{Year} + \varepsilon_{i,t} \quad (4)$$

where, *Scii* represents the concentration of the supply chain, *digital* represents the digital transformation index, *Control* represents control variables, *Firm* and *Year* represent the fixed factors of the enterprise and year, respectively. ε is a random error term. In order to minimize endogeneity interference in technology, this article applies one period lag to the core explanatory variable (*digital*) of the model. This article mainly focuses on the *digital* coefficient β_2 in Model (1). Based on the previous hypothesis, if β_2 is significantly negative, it means that the digital transformation of the enterprise will lower the concentration of the supply chain.

4. Empirical Results

4.1 Descriptive Statistical Results

Table 2 in the study presents the descriptive statistics of key variables, highlighting the variability in enterprise supply chain concentration and digital transformation indicators across different enterprises. The results show a considerable range in the concentration of enterprise supply chains, with the maximum value recorded at 79.92, the minimum at 2.74, and an average of 30.041. This wide range underscores the significant differences in supply chain concentration among various enterprises. Similarly, the digital transformation indicators exhibit substantial variability. The maximum value for these indicators is 64.748, the minimum is 23.276, and the mean stands at 36.297. These figures further emphasize the considerable disparity in the extent of digital transformation among

different enterprises.

4.2 Benchmark Regression Results

The benchmark regression results, as detailed in Table 3, provide insights into the relationship between enterprise digital transformation and supply chain concentration. In Model (1), which controls for firm and year fixed effects, the regression coefficient for the lagged enterprise digital transformation indicator (L.digital) is -0.099. This coefficient is statistically significant at the 1% level, indicating a negative correlation between digital transformation and supply chain concentration. Model (2) builds upon Model (1) by incorporating additional control variables. The inclusion of these controls leads to a slight increase in the magnitude of the regression coefficient (-0.090). This increase suggests that some of the factors influencing supply chain concentration might be accounted for by the control variables. Despite this adjustment, the result in Model (2) maintains its statistical significance at the 1% level. This continuation of significance reinforces the inference of a significant negative correlation between the degree of digital transformation and the concentration of the supply chain. In essence, a higher degree of digital transformation correlates with a notably lower concentration of the supply chain. Consequently, Research Hypothesis *H1* is validated by these findings.

Table 2. Descriptive statistics

VarName	Obs	Mean	SD	Min	Median	Max
Scii	24343	30.041	16.719	2.740	27.630	79.920
digital	24343	36.297	10.438	23.276	33.668	64.748
Age	24343	11.273	7.135	2.000	10.000	27.000
Board	24343	8.566	1.684	5.000	9.000	15.000
Growth	24343	0.166	0.387	-0.542	0.106	2.376
lev	24343	0.440	0.202	0.062	0.434	0.886
ROA	24343	0.034	0.062	-0.259	0.034	0.189
Cost	24343	0.721	0.170	0.199	0.752	1.009
Fee	24343	0.176	0.130	0.019	0.141	0.711

Table 3. Benchmark regression results

	(1) Scii	(2) Scii
L.digital	-0.099***	-0.090***
	(-5.653)	(-5.164)
Age		-1.255**
		(-2.109)
Board		-0.328***
		(-4.042)
Growth		0.698***
		(3.516)
lev		-4.743***
		(-6.071)
ROA		-0.622
		(-0.357)
Cost		1.373
		(1.217)
Fee		-3.543***
		(-2.942)
Firm	Yes	Yes
Year	Yes	Yes
_cons	35.179***	58.939***
	(48.950)	(6.263)
N	19769	19769
adj. R^2	-0.140	-0.134

Note: * * *, * *, * respectively represent significance levels at 1%, 5%, and 10%, with robust standard errors in parentheses. Hereinafter the same.

4.3 Robustness Test

To address the possibility of a delayed effect of digital transformation on supply chain concentration, the robustness of the research findings was tested by modifying the temporal framework of the analysis. This approach involved advancing the dependent variable (supply chain concentration) by two periods and similarly delaying the

core explanatory variable (digital transformation) by two periods. This adjustment in the time window aimed to capture the extended impact of digital transformation on supply chain concentration. The robustness test as shown in Table 4 yielded consistent results: regardless of the methodological adjustments, the influence of digital transformation on supply chain concentration consistently manifested as a significant negative inhibitory effect. This was evidenced by negative regression coefficients, which consistently passed the 1% statistical significance test. These findings suggest that digital transformation exerts a sustained negative impact on the concentration of supply chains over an extended period, thereby providing a support for hypothesis *H1*.

Table 4. Robustness test: extended observation window

	(1) **F2.Scii**	**(2)** **Scii**
digital	-0.070***	
	(-3.769)	
L2.digital	-1.070	-0.071***
		(-3.834)
Age		-0.951
	(-0.376)	(-1.617)
Board	-0.237***	-0.288***
	(-2.711)	(-3.346)
Growth	-0.242	0.483**
	(-1.189)	(2.331)
lev	-5.745***	-4.613***
	(-6.916)	(-5.413)
ROA	-3.965*	-2.360
	(-1.952)	(-1.306)
Cost	1.390	0.542
	(1.103)	(0.451)
Fee	1.548	-5.441***
	(1.128)	(-4.285)
Firm	Yes	Yes
Year	Yes	Yes
_cons	37.843**	54.187***
	(2.137)	(5.660)
N	16565	16565
adj. R^2	-0.182	-0.181

Table 5. Robustness test: changing model design

	(1) **Scii**	**(2)** **Scii**
L.digital	-0.091***	-0.119***
	(-5.197)	(-8.268)
Age	-1.292**	-0.084***
	(-2.171)	(-2.653)
Board	-0.331***	-0.411***
	(-4.066)	(-5.595)
Growth	0.686***	0.967***
	(3.454)	(4.922)
lev	-4.693***	-7.006***
	(-6.001)	(-10.002)
ROA	-0.624	-4.591***
	(-0.358)	(-2.705)
Cost	1.295	4.201***
	(1.146)	(4.147)
Fee	-3.634***	-5.106***
	(-3.016)	(-4.557)
Firm	Yes	No
Year	Yes	Yes
Industry	Yes	No
Province	Yes	No
_cons	59.426***	42.320***
	(6.306)	(33.425)
N	19769	19769
adj. R^2	-0.134	---

In the benchmark regression model, the analysis initially controlled only for firm-specific and year-specific fixed effects. Subsequent research expanded these controls to include additional factors such as industry and province. Table 5, column (1), demonstrates that the inclusion of these factors did not alter the significance of the coefficients, indicating the robustness of the initial findings across different industry sectors and geographical regions. Moreover, to validate the robustness of our conclusions under varying estimation methods, the coefficients were re-estimated using a random effects model. As shown in Table 5, column (2), the significance of the coefficients remained consistent.

4.4 Endogeneity Testing

The robustness test previously conducted affirmed the primary conclusion of this study: digital transformation significantly contributes to reducing the concentration of supply chains in enterprises. To further address potential endogeneity issues and strengthen the validity of this core finding, this study introduces the use of an instrumental variable.

The chosen instrumental variable is the average value of digital transformation among enterprises in the same industry and region. This selection is based on the rationale that the level of digital development in a company's location influences its degree of digitalization, satisfying the relevance criterion. Simultaneously, the digital development level within a specific industry and region is not directly linked to supply chain concentration, thus meeting the exogeneity requirement.

Table 6. Endogeneity test: instrumental variables

Variables	Scii
L.digital	-0.1629***
	(-3.675)
Control variable	Yes
Fixing Corporate effects	Yes
Fixing Year effect	Yes
Kleibergen-Paap rk LM statistics	1369.338
	[0.0000]
Kleibergen-Paap rk Wald F statistics	2359.742
	{16.38}
N	19610
R^2	0.05135

Note: () represents the robust standard error, [ ] represents the *P*-value, and {} represents the critical value of the Stock-Yogo weak identification test at the 10% level.

Table 7. Heterogeneity test

	State-Owned Enterprise	**Non-State-Owned Enterprise**
	Scii	Scii
L.digital	-0.106***	-0.063***
	(-3.500)	(-2.903)
Age	-1.191*	-1.438
	(-1.646)	(-1.210)
Board	-0.101	-0.492***
	(-0.801)	(-4.492)
Growth	0.258	1.027***
	(0.733)	(4.323)
lev	-4.492***	-4.368***
	(-3.162)	(-4.607)
ROA	0.729	-0.006
	(0.195)	(-0.003)
Cost	-0.533	4.021***
	(-0.273)	(2.870)
Fee	-2.654	-3.687***
	(-1.129)	(-2.616)
_cons	45.109***	38.257***
	(5.402)	(7.892)
Firm	Yes	Yes
Year	Yes	Yes
N	7893	11876
adj. R^2	-0.076	-0.201

In Table 6, the regression results using the instrumental variable method are presented. The Kleibergen-Paap rk LM statistic and the Wald F statistic indicate that the instrumental variables are free from issues like underidentification and weak identification. The results in Table 6 show that the Digital Transformation Index of enterprises remains significantly negative. This finding implies that the digital transformation of enterprises has a substantial and consistent effect in reducing the concentration of supply chains. This conclusion aligns with the initial results, thereby reinforcing the study's overarching hypothesis.

4.5 Heterogeneity Test

The prior analyses in this study assessed the impact of digital transformation on supply chain concentration from a holistic perspective, corroborating the interaction effect through various robustness tests. However, given the diversity in enterprise attributes, the influence of digital transformation on supply chain concentration could exhibit asymmetrical effects across different types of enterprises. To explore this possibility, the study conducts a sub-sample test, segregating the entire sample based on property rights attributes.

The empirical findings reveal distinct variations between state-owned and non-state-owned enterprises as shown in Table 7. In state-owned enterprises, the regression coefficient of digital transformation on supply chain concentration is -0.106, which is statistically significant at the 1% level. This result indicates a strong inhibitory effect of digital transformation on supply chain concentration in these enterprises. In contrast, for non-state-owned enterprises, while the inhibitory effect of digital transformation on supply chain concentration is also significant at the 1% level, it is notably less pronounced than in state-owned enterprises. Thus, the Research Hypothesis *H2* has been verified.

5. The Mechanism of the Impact of Enterprise Digital Transformation on Supply Chain Concentration

In this section, the study aims to identify and examine the channel mechanisms through which digital transformation influences the concentration of supply chains. Discretionary Accrual Earnings (DA) is selected as a proxy measure for information transparency. The rationale behind this choice is that higher Discretionary Accrual Earnings imply lower levels of information transparency and, consequently, increased market transaction costs for the enterprise. To elucidate the mechanism by which digital transformation affects supply chain concentration in enterprises, the study employs a series of recursive equations as shown in Eqs. (4)-(6).

$$DA_{i,t} = \beta_1 + \beta_2 \text{ digital }_{i,t-1} + \sum \beta \text{ Control }_{i,t} + \sum \text{ Firm } + \sum \text{ Year } + \varepsilon_{i,t} \quad (5)$$

$$\text{Scii }_{i,t+1} = \beta_1 + \beta_2 \text{ digital }_{i,t-1} + \beta_3 DA_{i,t} + \sum \beta \text{ Control }_{i,t} + \sum \text{ Firm } + \sum \text{ Year } + \varepsilon_{i,t} \quad (6)$$

Given the need for a time lag in the transmission of variables within the mediation effect model, and to mitigate potential reverse causality between variables, specific treatments are applied to the data. The explanatory variable (digital transformation) is lagged by one period, and the dependent variable (supply chain concentration, Scii) in Model (4) is pre-processed with a one-period lag. The mediating variable (DA) retains its current data structure. All other variable settings remain consistent with the previous sections of the study.

Table 8. Mechanism verification

	(1) Scii	(2) DA	(3) F.Scii
L.digital	-0.090*** (-5.164)	-0.000*** (-3.061)	-0.078*** (-4.137)
DA			4.198*** (3.542)
Control variable	Yes	Yes	Yes
Company/Year Fixed Effect	Yes	Yes	Yes
N	19769	19769	15711
adj. R^2	-0.134	-0.112	-0.195
	Enterprise digital transformation↑ - Information transparency ↑ - Supply chain concentration ↓		

The regression results obtained through the stepwise regression coefficient method are detailed in Table 8, providing a comprehensive understanding of the interplay between enterprise digital transformation, information transparency, and supply chain concentration. In the first step, presented in Table 8 column (1), the focus is on the

direct impact of enterprise digital transformation on supply chain concentration. The obtained coefficient for enterprise digital transformation is -0.090, which is statistically significant at the 1% confidence level. This finding confirms that digital transformation in enterprises contributes to a reduction in supply chain concentration, with a total effect of -0.090. This initial result sets the stage for further testing in the second step. Table 8 column (2) illustrates the second step of the regression analysis, examining the relationship between corporate digital transformation and discretionary accrual earnings. The regression coefficient here is also significant and negative at the 1% confidence level. This indicates that corporate digital transformation enhances information transparency and reduces information search costs, thereby justifying continuation to the third step of testing. The third step, shown in Table 8 column (3), incorporates both the explanatory variable (corporate digital transformation index) and the mediating variable (DA) into the regression equation. In this phase, the coefficient of the first phase remains significant at the 1% confidence level, while the coefficient of DA is 4.198, also significant at the 1% level. The significance of both the explanatory and mediating variables suggests that "improving information transparency" acts as a partial mediator in the relationship between digital transformation and supply chain concentration. Thus, Research Hypothesis *H3* is validated by these findings.

6. Research Conclusions and Policy Implications

Digital technology has revolutionized traditional business models, altering the interaction dynamics among enterprises, customers, and suppliers. Historically, enterprises favored a cluster-based model for selecting customers and suppliers, influenced by geographical, informational, and resource constraints. Presently, digital transformation transcends these traditional limitations, exerting a significant impact on supply chain strategic decision-making.

An empirical examination was conducted using data from Chinese A-share listed companies from 2011 to 2021, focusing on the impact and mechanism of digital transformation on supply chain concentration. The findings indicate that digital transformation notably reduces the concentration of enterprise supply chains. Notably, an asymmetric effect was observed under varying enterprise attributes; specifically, state-owned enterprises experienced a more profound reduction in supply chain concentration compared to non-state-owned counterparts. Furthermore, digital transformation enhances information transparency, reducing information search costs and thereby contributing to a decrease in supply chain concentration levels.

The fusion of digital technology with the real economy is a relentless trend. Enterprises leveraging digital technology for transformation can unlock greater developmental potential. The position of a company within the supply chain influences its competitive scale and intensity. Supply chain concentration reflects the enterprise's positioning within these relationships. The study suggests that digital transformation can modulate supply chain concentration, offering strategic directions for supply chain management. Enterprises are advised to augment the application of digital technology, facilitating the management of upstream and downstream partnerships, optimizing supply chain relationships, and enhancing their status within these networks. Additionally, transparency in enterprise information can optimize supply chain relationships. Enterprises should enhance their information gathering capabilities, mitigate information asymmetry, identify optimal partners among numerous upstream and downstream entities, and establish a foundation for robust development.

Policy recommendations include: First, governments should capitalize on digital transformation opportunities. Given the high costs associated with digital transformation, governments should implement policies supporting this transformation, with a focus on aiding small and medium-sized enterprises. Second, governments should guide companies in establishing digital supply chain platforms, fostering collaborative digital transformations along industrial chains. A government-centered digital supply chain platform can further reduce costs in supply chain interactions.

This study highlights the partial mediating role of information transparency but does not delve into other influencing mechanisms. Moreover, the relationship between digital transformation and supply chain concentration may be subject to additional factors, warranting further exploration in future research.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Acknowledgement

The authors are thankful to the institutional authority for completion of the work.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

Chen, J., Huang, S., & Liu, Y. H. (2020). From empowerment to empowerment: Enterprise operations management in a digital environment. *Manag. World*, *36*(2), 117-128.

Chen, J. & Liu, Y. H. (2021). Digital intelligence enabling operations management transformation: From supply chain to supply chain ecosystem. *Manag. World*, *37*(11), 227-240.

Coase, R. H. (1993). The nature of the firm. *Economica*, *4*(16), 386-405. https://doi.org/10.1111/j.1468-0335.1937.tb00002.x.

Ebert, C. & Duarte, C. H. C. (2018). Digital transformation. *IEEE Softw.*, *35*(4), 16-21. https://doi.org/10.1109/MS.2018.2801537.

Huang, D. Y. & Xi, H. B. (2022). Research on the value effect of enterprise digital transformation: Big data identification based on annual report text information. *Asia-Pac. Econ. Rev.*, *2022*(6), 93-104.

Li, Q., Liu, L. G., & Shao, J. B. (2021). The effects of digital transformation and supply chain integration on firm performance: The moderating role of entrepreneurship. *Front. Bus. Res. China*, *16*(4), 412-438. https://doi.org/10.3868/s070-007-022-0022-6.

Liu, X. H. (2023). Digital transformation, supply chain elasticity, and business performance of circulation enterprises. *J. Commer. Econ.*, *2023*(2), 161-164.

Matarazzo, M., Penco, L., Profumo, G., & Quaglia, R. (2021). Digital transformation and customer value creation in Made in Italy SMEs: A dynamic capabilities perspective. *J. Bus. Res.*, *123*, 642-656. https://doi.org/10.1016/j.jbusres.2020.09.057.

Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Res. Policy*, *48*(8), 1-9.

Ni, K. J. & Liu, X. Y. (2021). Digital transformation and enterprise growth: Logic and practice of China's capital market. *Bus. Manag. J.*, *43*(12), 79-97. https://doi.org/10.19616j.cnki.bmj.2021.12.005.

Qi, Y. D. & Xiao, X. (2020). Enterprise management transformation in the digital economy era. *Manag. World*, *36*(6), 135-152.

Sajnóg, A. & Rogozińska-Pawełczyk, A. (2022). Executive compensation and the financial performance of polish listed companies from the corporate governance perspective. *Equilibrium. Q. J. Econ. Econ. Policy*, *17*(3), 607-633. https://doi.org/10.24136/eq.2022.021.

Skiti, T., Luo, X. M., & Lin, Z. J. (2022). When more is less: Quality and variety trade-off in sharing economy platforms. *J. Manage. Stud.*, *59*(7), 1817-1838. https://doi.org/10.1111/joms.12807.

Wang H. F., Wang, M. T., Wang, X. Y., Ma, P. P., & Zhang, X. Y. (2021). A review of supply chain concentration research: Analysis based on bibliometric and knowledge graph. *Friends Account.*, *2021*(19), 115-122.

Wang, J. B., Li, Z. N., & Li, X. M. (2023a). Digital transformation and total factor productivity of enterprises: A mechanism test based on resource allocation efficiency. *Sci. Technol. Prog. Countermeas.*, 1-11.

Wang, L. & Chen Z. J. (2020). How does value co creation affect the improvisation ability of innovative enterprises: Case study based on resource dependency theory. *Manag. World*, *36*(11), 96-110.

Wang, Y., Feng, X. Q., & Hou, D. S. (2023b). Can digital transformation of enterprises improve analyst prediction accuracy: Based on the dual perspectives of information disclosure and information mining. *J. Cent. South Univ. Fin. Law*, 1-14.

Wu, F., Hu, H. Z., Lin, H. Y., & Ren, X. Y. (2021). Digital transformation of enterprises and capital market performance: Empirical evidence from stock liquidity. *Manag. World*, *37*(7), 130-144.

Xiao, T. S., Sun, R. Q., Yua, C., & Sun, J. (2022). Digital transformation, human capital structure adjustment and labor income share. *Manag. World*, *38*(12): 220-237.

Zhang, H. & Zhang, Q. W. (2023). How does digital transformation facilitate enterprise total factor productivity? The multiple mediators of supplier concentration and customer concentration. *Sustainability*, *15*(3), 1896. https://doi.org/10.3390/su15031896.

Zhang, R. Z. (2022). Digital technology and supply chain efficiency: Theoretical mechanism and empirical evidence. *Res. Econ. Manag.*, *43*(5), 60-76. https://doi.org/10.13502/j.cnki.issn1000-7636.

Zhang, T. S. & Zhang, C. J. (2022). Supply chain concentration, market position, and commercial credit transmission. *Friends Account.*, *2022*(14), 29-35.

Zhao, L. & Huang, H. (2022). Corporate digital transformation, supply chain collaboration and cost stickiness. *Contemp. Fin. Econ.*, 5, 124-136.